Plant and Soil 2015 vol.395 N1-2, pages 231-241

Land use change decreases soil carbon stocks in Tibetan grasslands

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Abstract

© 2015, Springer International Publishing Switzerland. Backgrounds and aims: Land use is an important factor affecting soil organic carbon (SOC) dynamics and can produce positive C climate feedback, but its effects remain unknown for Tibetan ecosystems. Methods: Recent land use changes have converted the traditional winter Kobresia pastures of nomads in the northeastern Tibetan Plateau to Elymus pastures or even to cropland. Detailed SOC measurements up to 30-cm depth were combined with analysis of δ13C, δ15N, bulk density, microbial C, and N contents in three land use types. Results: Bulk density was decreased by conversion from Kobresia pasture to cropland but increased by conversion to Elymus pasture. The loss of 1 % of SOC caused by land use change leads to δ13C increase of 0.8 ‰. Conversion to cropland significantly decreased SOC stocks (10 %) and microbial biomass C, but the C loss (1.6 %) was insignificant in Elymus pasture. Land use changes strongly increased soil δ15N in the top 5 cm. Conclusions: Conversion to Elymus pasture did not change the C stocks, but conversion to cropland decreased C stocks by 10 % within 10 years. Soil δ13C and δ15N data indicate acceleration of C and N cycling due to the replacement of Kobresia pasture by Elymus pasture and cropland.

http://dx.doi.org/10.1007/s11104-015-2556-8

Keywords

Alpine meadow, Cropland, Pasture, Soil organic carbon, Total nitrogen, δ13C, δ15N